



## Clinical practice

## A profile of abdominal and pelvic injuries in medico-legal autopsy



Nuwadatta Subedi, MD Lecturer <sup>a,\*</sup>, B.N. Yadav, MD Professor <sup>b</sup>,  
Shivendra Jha, MD Associate Professor <sup>b</sup>,  
Ishwari Sharma Paudel, PhD Additional Professor <sup>c</sup>,  
Rajendra Regmi, MS Associate Professor, HOD <sup>d,e</sup>

<sup>a</sup> Department of Forensic Medicine and Toxicology, BP Koirala Institute of Health Sciences, Dharan, Nepal

<sup>b</sup> Department of Forensic Medicine, BP Koirala Institute of Health Sciences, Dharan, Nepal

<sup>c</sup> School of Public Health and Community Medicine, BP Koirala Institute of Health Sciences, Dharan, Nepal

<sup>d</sup> Department of Surgery, BP Koirala Institute of Health Sciences, Dharan, Nepal

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## ABSTRACT

Abdomino-pelvic region is vulnerable to injury in various forms of trauma. This study was undertaken with objectives to study the pattern and type of external and internal abdominal and pelvic injuries and to identify the risk organs in abdomen and pelvis susceptible to trauma among the medico-legal autopsies at the mortuary of a referral centre in eastern Nepal during the period of one year ( $n = 80$ ). Males constituted 80% of the cases and the mean age of the victims was 30.76 years. The cause of trauma was Road Traffic Accident in 82.5%. The manner of death was accidental in 87.5% and homicidal in 11.25% cases. Liver (57.5%) was the most common organ injured followed by spleen in 37.5% cases. Multiple organs injury was seen in 67.5% and absence of any external injuries was noted in 31.25% cases. Autopsy can play a role in establishing the missed injuries and be helpful to widen the knowledge of the medical faculty in early diagnosis and management of such injuries.

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## 1. Introduction

The abdomino-pelvic region has been considered as one of the most vulnerable regions of the body and injuries involving this area of the body very serious.<sup>1</sup> Since abdomino-pelvic cavity contains vital organs like liver, spleen, kidney, stomach and intestine, trauma to this part of the body is life threatening.<sup>2</sup> Due to soft and yielding nature of the abdominal wall, application of even a heavy force may not cause any external wound on the abdominal wall but the transmitted force may cause serious internal wound.<sup>3</sup> Because of its size and anatomical position, abdomino-pelvic region is a major site of trauma in road accidents.<sup>4</sup> Injuries to the abdomen and pelvis are not always isolated but often associated with injuries to other parts, viz., head, chest, spine, extremities etc. Hence, the presence of intra-abdominal and intra-pelvic involvement may be

overlooked or discovered later. Early recognition of the injury and immediate treatment are mandatory in saving the lives of many of these patients. If overlooked and neglected, this situation would eventually have medico-legal implications.

This study was undertaken to analyse the pattern of abdomino-pelvic injuries which were brought for medico-legal autopsy in the mortuary of a referral centre in eastern Nepal. The study of injuries from the autopsy findings can be helpful to widen the knowledge of the medical faculty in the field of early diagnosis and management. No published studies from Nepal of this kind have been found till date.

## 2. Objectives of the study

The study was conducted with objectives to analyse the pattern and type of external and internal abdomino-pelvic injuries and to identify the risk organs in this region susceptible to trauma.

## 3. Materials and methods

It is a cross sectional observational post-mortem study of abdomino-pelvic injuries. Materials for the present study were

\* Corresponding author. Present address: Department of Forensic Medicine, College of Medical Sciences, Bharatpur, Chitwan, Nepal. Tel.: +977 9842039565.

E-mail addresses: [subedind@yahoo.com](mailto:subedind@yahoo.com) (N. Subedi), [ydv98@yahoo.com](mailto:ydv98@yahoo.com) (B.N. Yadav), [drshivendrajha@gmail.com](mailto:drshivendrajha@gmail.com) (S. Jha), [is\\_paudel@yahoo.com](mailto:is_paudel@yahoo.com) (I.S. Paudel), [rajdrregmi@yahoo.com](mailto:rajdrregmi@yahoo.com) (R. Regmi).

<sup>e</sup> Present address: Department of Surgery, Norvic International Hospital and Medical College, Kathmandu, Nepal.

collected from the medico-legal autopsies, showing abdominal and/or pelvic injuries, carried out at the mortuary of a referral centre in eastern Nepal during the period from 14th April 2010 to 13th April 2011. The total number of cases studied was 80.

All the autopsies showing abdominal and/or pelvic injuries caused by known mechanical trauma were included in our study. The bodies that were decomposed and where the cause of trauma was not known were excluded from the study.

### 3.1. Data collection tools

Data was collected systematically in a detailed pretested pro-forma developed for the autopsy evaluation of abdominal and pelvic injury victims. The detailed information about the cases was collected from different sources including:

1. The inquest report and other relevant papers brought by the police along with the dead body.
2. Interviewing the police personal accompanying the dead body.
3. Interviewing the relatives, neighbours, friends or other persons accompanying the dead body.
4. Autopsy examination findings.
5. Relevant clinical history and findings found upon admission in hospital, and subsequently.

All collected data were compiled and entered into the Microsoft Excel. Analysis was done using SPSS (Statistical Package for Social Sciences) version 17.0. Observations were recorded, analysed and discussed. Ethical clearance was taken from the Institutional Ethical Committee of B.P. Koirala Institute of Health Sciences.

## 4. Results and observation

Among a total of 479 autopsies performed in the period, 122 were Road traffic accidents (RTA), and 49 other mechanical traumatic causes. In our series, some forms of abdomino-pelvic injuries were found in 46.78% out of total 171 mechanical trauma cases. 52.1% of the RTA fatalities showed the presence of abdomino-pelvic injuries.

It was observed that most (80%) of the victims were males while females comprised of 20% cases. The mean age was 30.76 years with standard deviation of 15.2. More than half of the victims (52.5%) belonged to the age group 16–30 years. The age group of 21–30 years comprised of 35% and 11–20 years group contained 20% cases among which most of them (15 out of total 16) were males. 31–40 years group comprised of 15%, children below 10 years were 6.3% while only 2.5% of the victims belonged to the group of more than 60 years.

It was found that 46.2% of the victims belonged to the lower, 37.5% from middle and 16.3% from higher socioeconomic group. The victims of rural and urban background comprised of 58.8% and 41.2% cases respectively.

The cause of trauma and distribution with respect to sex is shown in Table 1. Non-penetrating injury was present in 88.75%, most of them (93%) were RTA. Penetrating injury was evident in 11.25% of the cases, the causes being firearm and stab injury in 44.4% cases each. In one case of fall from building, the victim sustained penetrating injury to the abdomen caused by projecting iron rod on the ground. The manner of death was accidental in 87.5% cases, among which 92.8% were due to RTA. Rest 7.2% resulted due to fall from a height. In 11.25% cases, the death was homicidal and in one case the manner of death was undetermined.

The type of road users and their intoxication status is shown in Table 2. When considered all the 80 cases, 32.5% were intoxicated

**Table 1**  
Cause of trauma.

Cause of trauma	Sex		Number (%)
	Male	Female	
Road traffic accident	52	14	66 (82.5)
Fall from height	5	—	5 (6.3)
Firearm injury	3	1	4 (5.0)
Stab injury	4	—	4 (5.0)
Assault by blunt weapons	—	1	1 (1.3)
Total	64	16	80 (100)

**Table 2**  
Type of road users and intoxication status.

Type of road users	Intoxication		Number (Percent)
	Yes	No	
Pedestrians	4	16	20 (30.3)
Cyclists	2	6	8 (12.1)
Motorcyclists and drivers	10	9	19 (28.8)
Pillion riders	5	3	8 (12.1)
Passengers	2	9	11 (16.7)
Total (Percent)	23 (34.85)	43 (65.15)	66 (100)

at the time of incidence. The predisposing factors for RTA are depicted in Table 3.

In 62.5% cases, the victims were brought to hospital and some forms of treatment were started. 17.5% died on the spot or shortly after the incidence while 20% on the way to hospital. Some form of first aid was done in 25% of the cases only.

The frequency of organs injured in fatalities with abdominal and pelvic trauma is represented in Fig. 1. Multiple organ injury was seen in 67.5% cases. Single organ was found to be involved in 32.5%, injury to two organs in 27.5%, three organs in 18.8% and four or more organs injury in 21.3% cases. The distribution of external injuries in the abdomino-pelvic region on gross examination is shown in Table 4. The involvement of other body regions along with abdomino-pelvic injuries is shown in Table 5.

Exsanguination was the most common cause of death in 55% of the cases. The combined effect of CNS injury and haemorrhage lead to death in 32.5%, the complications of injury like septicaemia, multi organ failure etc was the cause in 7.5%, and CNS injury alone in 5% cases. In fatalities due to CNS injury alone, minor injuries in the abdomino-pelvic region were noticed.

## 5. Discussion

Death or severe injuries caused as a result of abdomino-pelvic injuries are common. Most of the fatalities involving this region are as a result of RTAs.<sup>1,4,5</sup> The frequency of abdomino-pelvic injuries in our study is similar to that shown by other studies.<sup>6,7</sup> In the Eastern region of Nepal, vehicular accidents are the most common contributory factors to the abdomino-pelvic trauma as power driven as well as body and hand driven running on the same road,

**Table 3**  
Predisposing factors for the RTA.

Predisposing factors	Number (Percent)
Victim carelessness	14 (21.2)
High speed vehicle	19 (28.8)
Defect in the road	7 (10.6)
Intoxicated driver	16 (25.0)
Defect in the vehicle	3 (4.5)
Others	3 (4.5)
Unknown	4 (6.0)
Total	66 (100)

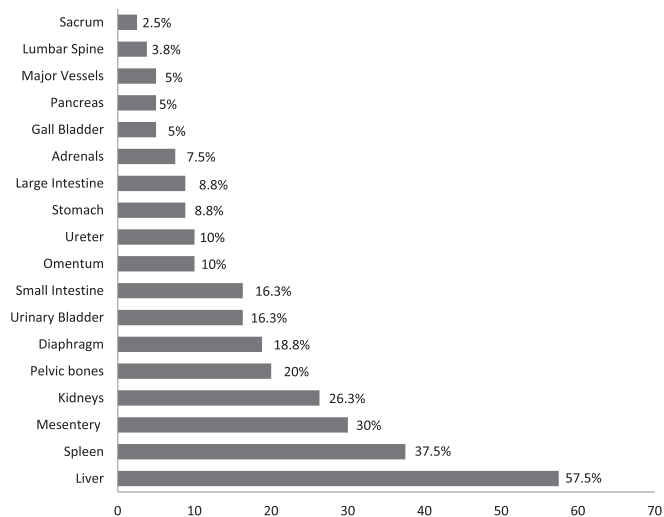


Fig. 1. Percentage of abdominal and pelvic organs involved.

faulty roads, poor maintained public transport vehicles etc. Moreover, vehicles not having effective front and rear lights are used even in the nights and often parked on the roads without lights increasing the occurrence of motor vehicular accidents.

The most involved age of 11–30 years may lead more active life and are at the peak of their creativity having the tendency to take risks, alcoholic intoxication etc. thereby subjecting themselves to the dangers of accidents and injuries. The findings tally with those of other studies.<sup>1,4,5,8</sup> Involvement of the economically productive age groups causes a serious economic loss to the community. Males were predominantly involved in our study with male: female ratio being 5:1. The fact that males are usually the earning members of the families makes them more mobile and thus, vulnerable to the accidents. Males may be involved in violence and sports and consume alcohol and other drugs more often than their female counterparts. Other studies have shown similar results.<sup>1,4,5,8–10</sup>

The lower class are commonly affected as they have to work in the roads, constructions etc. without proper safety measures. Moreover, most of the illiterate and lower education group victims are from the lower class families and have poor knowledge on traffic rules and safety measures in work conditions owing to greater chances of being victims of accidents. In similar studies,<sup>1,4,5,11</sup> it was noticed that people from middle and low socioeconomic class were affected more.

We attempted to determine the community character of the victims irrespective of the location of the incident. It is comparable by that shown by Mishra et al.<sup>11</sup> Putul Mahanta<sup>5</sup> showed urban incidents of RTA was higher. It is in contrast with our study as he showed the site of incidence regardless of the characters of victims. The greater prevalence to the rural people can be attributed to the fact that this population is the majority in Nepal. Moreover, the rural people who are poorly educated or illiterate are unaware of the traffic rules and may become the victims of RTAs frequently.

Table 4

External Injuries of the Abdomino-pelvic region.

Types of external injuries	Number (Percent)
No injury	25 (31.2)
Abrasion	17 (21.5)
Contusion	12 (15)
Abraded contusion	12 (15)
Laceration	5 (6.3)
Penetrating injury	9 (11.3)
Total	80 (100)

Table 5

Associated body injuries.

Combination of injuries in body regions	Number (Percent)
Abdomino-pelvic injuries only	9 (11.3)
Abdomino-pelvic and head	5 (6.3)
Abdomino-pelvic and thorax	12 (15.0)
Abdomino-pelvic and extremities	14 (17.5)
Abdomino-pelvic and $\geq 2$ body regions	40 (50.0)
Total	80 (100)

Among the causes of abdomino-pelvic trauma, RTA contributed to 82.5% of cases. RTA as the common cause of abdomino-pelvic injuries was also shown by other studies.<sup>4,5,7,10</sup> Comparable to our study, other studies showed blunt trauma in majority of cases.<sup>1,4,12</sup> RTA remains the commonest cause of blunt abdominal injury worldwide.<sup>13–17</sup> There were five cases of fall from a height in our study. None of them had used any safety measures. This necessitates the awareness to the public regarding the use of safety measures during those dangerous works.

Among the 66 RTA victims, 34.85% were intoxicated during the time of incidence. More importantly, more than half (52.63%) motorized vehicle drivers were intoxicated. The role of alcohol in impairing driving ability is well documented. The association of alcohol consumption is related to free availability and non-restriction on sale. The government should learn from other countries and have some strong legal enforcement against drinking and driving. It also necessitates awareness to the public regarding the deleterious effects of alcohol intake during driving. It obviates the need for frequent traffic check posts, provision of alcohol breath analyser to the police and formulation and proper implementation of legislation.

Among the type of road users, most of the victims (30.3%) consisted of pedestrians. Higher incidence of abdomino-pelvic trauma among pedestrians has also been reported in other centres.<sup>4,5,11,18–20</sup> The next common in the group were motorcyclists comprising 27.3% of cases. Evelyn Wong et al.<sup>7</sup> reported most of the victims of fatal RTA were motorcyclists. The increased prevalence of motorcyclist's involvement could be due to high speed impacts and lack of body restraints.

In the fatal RTA cases, inquiry was made regarding the predisposing factors for the accidents. Human errors were the most common. The leading factor was high speed vehicle that consisted of 28.8% cases. Followed by it was intoxication of drivers in 25% and carelessness in the part of the victims themselves in 21.2%. Disobeying the traffic rules by opponent vehicles contributed in 4.5% cases. Human errors as the most common factor in RTA were also stated by other authors.<sup>11,21</sup> It necessitates the proper awareness and education to the public regarding the hazards of RTA. The ill maintained roads like narrow roads, ditches, crowding in the highways need to be properly monitored and maintained.

In our study, liver was the most commonly injured organ constituting of 57.5% cases. Liver as the most commonly injured organ in abdominal injuries was also shown in other studies.<sup>4,8,10,22,23</sup> The extreme vulnerability of liver to be injured by trauma can be attributed to its large size, fixed position and its inelasticity.<sup>24</sup> Spleen was the second most common injured organ besides liver. Incidence of diaphragm injuries was comparable to that shown by other studies.<sup>4,5</sup> All of the gall bladder injuries were associated with liver injuries.

Stomach was injured in 8.8% cases. The low incidence can be explained by the well protected position behind the left lobe of liver and lower left rib cage. The thickness and strength of the stomach wall might be the other factors.<sup>25</sup> Injury to the small intestines was associated with mesenteric injuries in 53.8%, liver and spleen injuries each in 30.8%. As bowel loops travel from their mesenteric attachments, involvement with mesentery injuries is common.

Injury to the large Intestine was noticed in 8.8% cases and all were due to RTA. All the injuries noticed were contusions only. The frequencies reported by other studies are well tuned with ours.<sup>1,4,5</sup>

Pancreas was injured in 5% of the cases in which all the cases resulted from RTA. The Low incidence of pancreatic injury can be explained by its deep and well protected anatomical position. The results in other studies are comparable to our study.<sup>1,4,5</sup> Injuries to the kidneys were present in 26.2% cases. Right kidney was affected more commonly (52.3%) which may be due to the side of impact. Blunt trauma lead to the injury in 85.7% in which all the cases were RTA. The common involvement of blunt trauma and RTA to the renal injury has been shown in other settings also.<sup>4,13,26,27</sup> All the adrenal injuries were present in association of renal injuries. Among the five cases of major vascular injuries of the abdomino-pelvic region, descending aorta was lacerated in two and inferior venacava and right renal artery in one case each. The similar incidence of vascular injuries in abdomino-pelvic trauma was noted by other researchers.<sup>1,4,5</sup>

Urinary bladder injuries were found in 16.3% cases and all of them were associated in conjunction of pelvic fractures. The incidence of urinary bladder injury tallies well with other studies.<sup>1,4,5</sup> Urethral injuries were seen in 10% cases, all of them being associated with pelvic fractures. 87.5% urethral injuries were present in males. The findings of our study are well supported by other studies.<sup>1,4,5,13</sup> Prostrate was injured in a firearm injury case where the bullet penetrated the pelvic bone in the pubic region, right side of midline, disrupted the ureter, contused the bladder and the prostrate. Uterus showed contusion in a case and was caused by RTA.

Lumbar spinal column was involved in 3.8% cases and the frequency is comparable to that shown by Abdul Halim et al.<sup>1</sup> and Akash Jhanjee.<sup>4</sup> Pelvic bones were fractured in 20% cases. The frequency of pelvic fracture in our study is similar to that of Putul Mahanta<sup>5</sup> and Abdul Halim et al.<sup>1</sup> Demetrios Demetriades et al.<sup>28</sup> showed pelvic fractures are frequently associated with liver and genitourinary injuries, similar to our study.

Multiple organs involvement in the abdomino-pelvic region was seen in 67.5% of the cases. Similar findings were noted by other studies.<sup>1,4,5,29</sup> It can be explained by the following facts:

- Blunt trauma over the abdomino-pelvic region results in compression, traction or bursting forces which ultimately widely involves the internal viscera.
- The penetrating injuries to the region can injure multiple organs along the path of the weapon.
- Penetrating wounds of the abdomen mainly from firearms often causes widespread visceral damage because of missile's capricious course, ricocheting effect and burning effect as a result of thermal injury.

The sole involvement of abdomino-pelvic region was seen in 11.3% of the cases only and of two or more body regions along with abdomino-pelvic injuries in 50% of the cases. This shows that injuries to the abdomen and pelvis are frequently associated with other regional injuries. So, the injuries in this region may not be diagnosed or detected later that will degrade the prognosis of the injury. Early recognition of the injury and immediate treatment are mandatory in saving the lives of many of these patients.

No any evidence of external injuries on the abdomino-pelvic wall was found in 31.25%. All were the cases of non penetrating trauma. It signifies that in cases of blunt injury, though injuries are not evident externally, internal organs can still be involved. The poor correlation between external and internal injuries has also been documented by other studies.<sup>30,31</sup> The elasticity of the region and nature of clothing may contribute to the absence of surface injuries. The determination of the underlying cause of death is

more accurate when an autopsy is performed. It is necessary to detect injuries to the internal organs not only in the field of Forensic Medicine but also with respect to emergency medical care. In the context of death after trauma, it is particularly important that an autopsy is performed in order not to underestimate the severity of the injuries and thereby underscore them.

There is a need for the medico-legal experts to spread awareness about the severity of the fatal abdomino-pelvic injuries. The forensic experts must analyse the various fatal injuries as to their nature and the mechanism of causation with a view to help the law enforcing agencies in investigation process and also to suggest measures for their prevention.

## 6. Conclusion

Injuries in the abdomino-pelvic region are frequent findings in cases of traumatic deaths. RTA is the major cause of the injury to the region. Liver is the most frequently injured organ, spleen occupying the second place. The abdomino-pelvic injuries are frequently associated with injuries to the extremities, thorax and head. Multiple organ injuries are common in this region. Though, the injuries in penetrating trauma are obvious, fatal internal injuries can be present without an evidence of external injuries in non penetrating cases. Autopsy can play a role in establishing all the missed injuries and be helpful to widen the knowledge of the medical faculty in early diagnosis and management of such injuries.

### Ethical approval

The study was approved ethically by the Institutional Ethical Committee of B.P. Koirala Institute of Health Sciences.

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### Conflict of interest

None declared.

## References

- Mansar Abdul Halim, Aadeel Muhammad, Osman Khairul, Sharin Iskandar AW. An epidemiological study of abdomino-pelvic injury trauma in post-mortem cases at Hospital Kuala Lumpur between the year of 2002–2003. *JSKM* 2008;**6**(2):65–73.
- Bishop M, Shoemaker WC, Avakian S. Evaluation of a comprehensive algorithm for blunt and penetrating thoracic and abdominal trauma. *Am Surg* 1991;**57**(12):737–46.
- Nandy A. *Principles of forensic medicine*. Calcutta: New Central Book Agency(P) Limited; 1995. p. 311.
- Jhanjee A. A post mortem study of abdominal and pelvic trauma in Central Delhi. *Anil Aggarwal's Internet J Forensic Med Toxicol* 2000 July–Dec;**1**(2):1 [serial online]. [cited 2013 Feb 4]. Available from URL: <http://www.geradts.com/anil/ij/indexpapers.html>.
- Mahanta Putul. Study of abdominopelvic injuries in victim of road traffic accident. *Int J Med Toxicol Leg Med* Jan–Mar 2010;**12**(3):24–31.
- Ravi Kiran E, Muralidhar Saralaya K, Vijaya K. Prospective study on road traffic accidents. *J Punjab Acad Forensic Med Toxicol* 2004;**4**:12–6.
- Wong Evelyn, Leong Mark KF, Anantharaman Venkataraman, Raman Lata, Wee Keng Poh, Chao Tzee Cheng. Road traffic accident mortality in Singapore. *J Emerg Med* 2002;**22**(2):139–46.
- Benerjee KK, Agarwal BBL, Kohli. Study of thoraco-abdominal injuries in fatal road traffic accidents in North East Delhi. *J Indian Acad Forensic Med* 1997;**4**(1):40–3.
- Verma SK, Biswas Gautam. Comparing short term survival by ISS and NISS in road traffic accidents. *Indian Internet J Forensic Med Toxicol* 2003;**1**(1).
- Numan Husaini, Chavan KD, Bangal RS, Singh B. Pattern of thoraco-abdominal injuries in rural region. *Indian J Forensic Med Pathol* 2009 July–Sept;**2**(3):97–103.
- Mishra B, Sinha N, Sukhla S, Sinha A. Epidemiological study of road traffic accident cases from Western Nepal. *Indian J Community Med* 2010 Jan;**35**(1):115–21.
- Ayoade BA, Salami BA, Tade AO, Musa AA, Olawoye OA. Abdominal injuries in Olabisi Onabanjo University Teaching Hospital Sagamu, Nigeria: pattern and outcome. *Niger J Orthop Trauma* 2006 Dec;**5**(2):45–9.



13. Lynch D, Martinez-Piñeiro L, Plas E, Serafetinidis E, Turkeri TL, Hohenfellner M. *Guidelines on urological trauma*. European Association of Urology; 2003 Feb. p. 5–70.
14. Nwabunike T. Closed and penetrating abdominal injuries in Nigerian Igbos. *Injury* 1984;**15**:372–5.
15. Ong CL, Png DJ, Chan ST. Abdominal trauma – a review. *Singapore Med J* 1994;**35**:269–70.
16. Udoeyop UW, Iwatt AR. Abdominal trauma in south-eastern Nigeria. *Cent Afr J Med* 1991;**37**:409–15.
17. Edino ST. Pattern of abdominal injuries in Aminu Kano Teaching Hospital, Kano. *Niger Postgrad Med J* 2003;**10**:56–9.
18. Siddique MAB, Rahman MK, Hannan ABMA. Study on abdominal injury: an analysis of 50 cases. *Trans Anal J* 2004;**17**(2):84–8.
19. Jha N, Aggrawal CS. Epidemiological study of road traffic accident cases: a study from Eastern Nepal. *Reg Health Forum* 2004;**8**(1):15–22.
20. Yawe King David T, Onoja F, Inunduh P. Blunt injuries to the abdomen in Makurdi, Benue State: Nigeria. *Niger J Surg Res* 2005;**7**(1–2):173–5.
21. Odero Wilson, Khayesii Meleckidzedeck, Heda PM. Road traffic injuries in Kenya: magnitude, causes and status of intervention. *Inj Control Saf Promot* 2003;**10**(1–2):53–61.
22. Snyder RG, Snow CC. Fatal injuries resulting from extreme water impact. *Aerosp Med* 1967 Aug;**38**(8):779–83.
23. Arajärvi E, Santavirta S, Tolonen J. Abdominal injuries sustained in severe traffic accidents by seatbelt wearers. *J Trauma* 1987 Apr;**27**(4):393–7.
24. Simmons Patterson FM. Traumatic wounds of the liver. *Am J Surg* 1962 Dec;**104**(6):808–11.
25. Decker GAG. *Lee McGregor's synopsis of surgical anatomy*. Bristol: John Wright and Sons LTD; 1986.
26. Iqbal N, Chughtai MN. Management of blunt renal trauma: a profile of 65 patients. *J Pak Med Assoc* 2004;**54**:516.
27. Altman AL, Haas C, Dinchman KH, Spirnak JP, et al. Selective non-operative management of blunt grade 5 renal injury. *J Urol* 2000;**164**(1):27–31.
28. Demetriades Demetrios, Karaiskakis Marios, Velmahos George C, Alo Kathleen, Murray James, Chan Linda. Pelvic fractures in pediatric and adult trauma patients: are they different injuries? *J Trauma* 2003;**54**:1146–51.
29. Klinich, Kathleen D, Flannagan, Carol AC, Nicholson, Kristen, Schneider, Lawrence W, Rupp, Jonathan D. Abdominal injury in motor-vehicle crashes. UMTRI-2008-40.
30. Nishitani Yoko, Okazaki Shunichiro, Suzuki Kengo, Imabayashi Kiyomi, Katada Ryuichi, Matsumoto Hiroshi. The discrepant severity of external and internal injuries in a traffic accident: the cushioning effect via a human body against direct impact. *Am J Forensic Med Pathol* 2009;**30**:186–7.
31. Yartsev A, Langlois NE. A comparison of external and internal injuries within an autopsy series. *Med Sci Law* 2008 Jan;**48**(1):51–6.